US012060936B2

(12) United States Patent
Lee et al.

(10) Patent No.: US 12,060,936 B2
(45) Date of Patent: *Aug. 13, 2024

(54) **ELECTRONIC SHIFT CONTROL APPARATUS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **18/341,068**

(22) Filed: **Jun. 26, 2023**

(65) **Prior Publication Data**

US 2023/0332684 A1 Oct. 19, 2023

Related U.S. Application Data

(63) Continuation of application No. 17/530,105, filed on Nov. 18, 2021, now Pat. No. 11,746,897.

(30) **Foreign Application Priority Data**

Apr. 15, 2021 (KR) 10-2021-0048915

(51) **Int. Cl.**

F16H 59/12 (2006.01)
F16H 61/00 (2006.01)
(Continued)

(52) **U.S. Cl.**

CPC ***F16H 61/24*** (2013.01); ***F16H 59/12*** (2013.01); ***F16H 61/0006*** (2013.01); *F16H 2059/081* (2013.01); *F16H 2061/241* (2013.01)

(58) **Field of Classification Search**

CPC F16H 61/24; F16H 2061/241; F16H 59/12; F16H 61/0006; A63F 13/285; G05G 1/10; G05G 5/03

See application file for complete search history.

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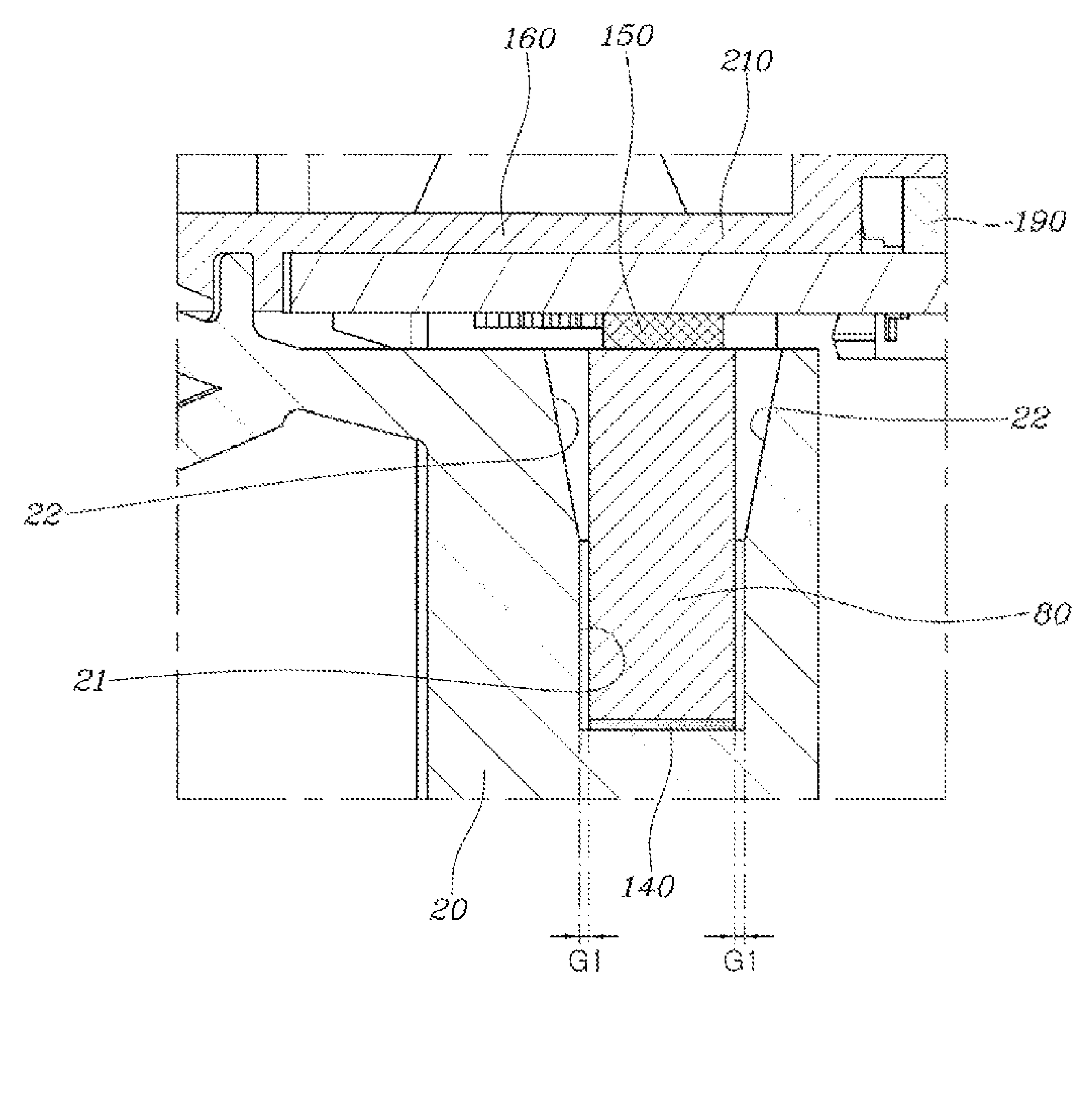
(57) **ABSTRACT**

An electronic shift control apparatus includes a shift dial that is operated by a driver to select an R-range, an N-range, and a D-range, a P-range motor that is operated to select a P-range, and a haptic motor that generates a haptic signal. When a driver shifts into a specific shift range of a vehicle by operating the shift dial or the P-range button, the haptic signal is configured to be transmitted to the driver.

15 Claims, 9 Drawing Sheets



(51) **Int. Cl.**
F16H 61/24 (2006.01)
F16H 59/08 (2006.01)

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FIG. 1

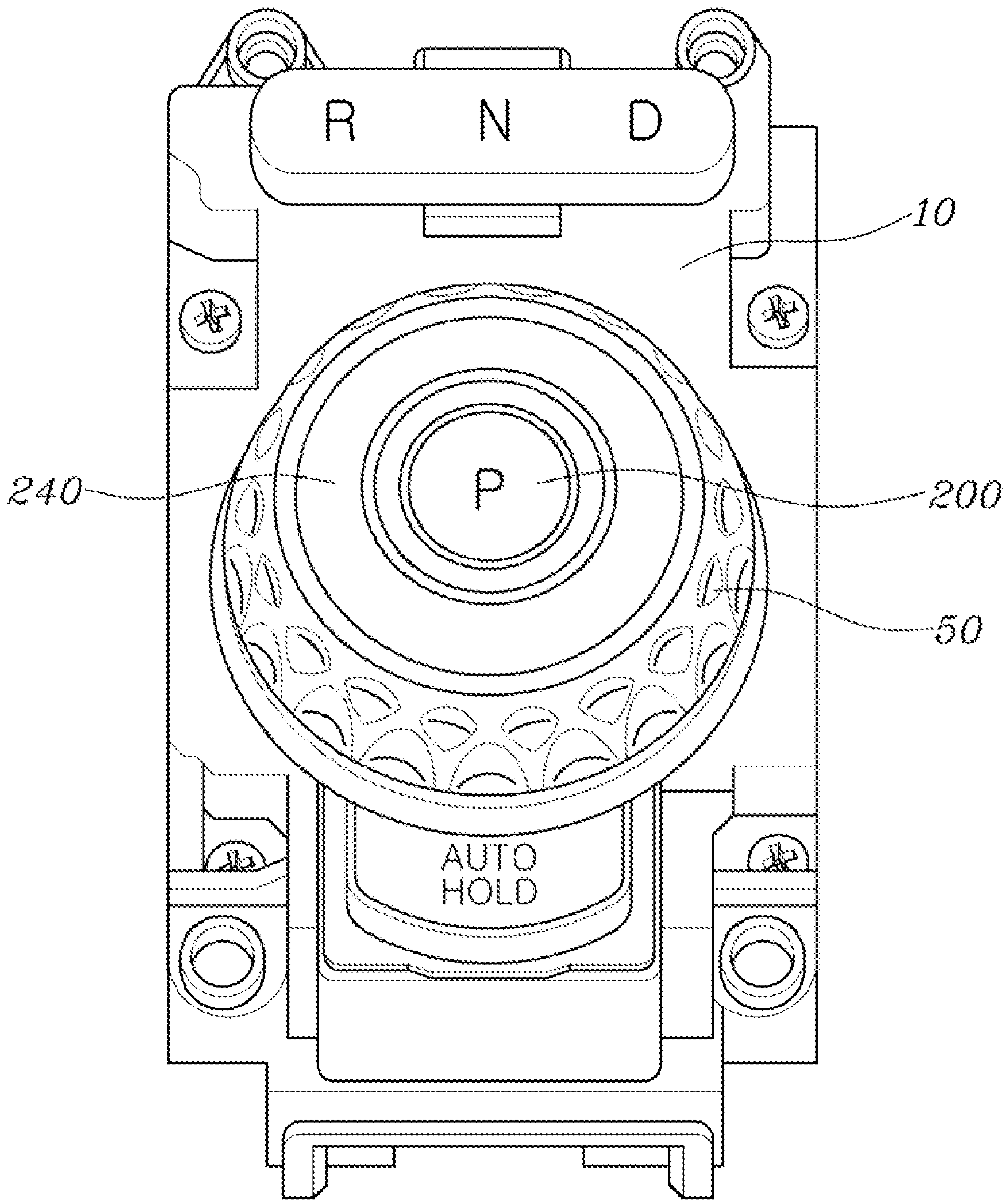


FIG. 2

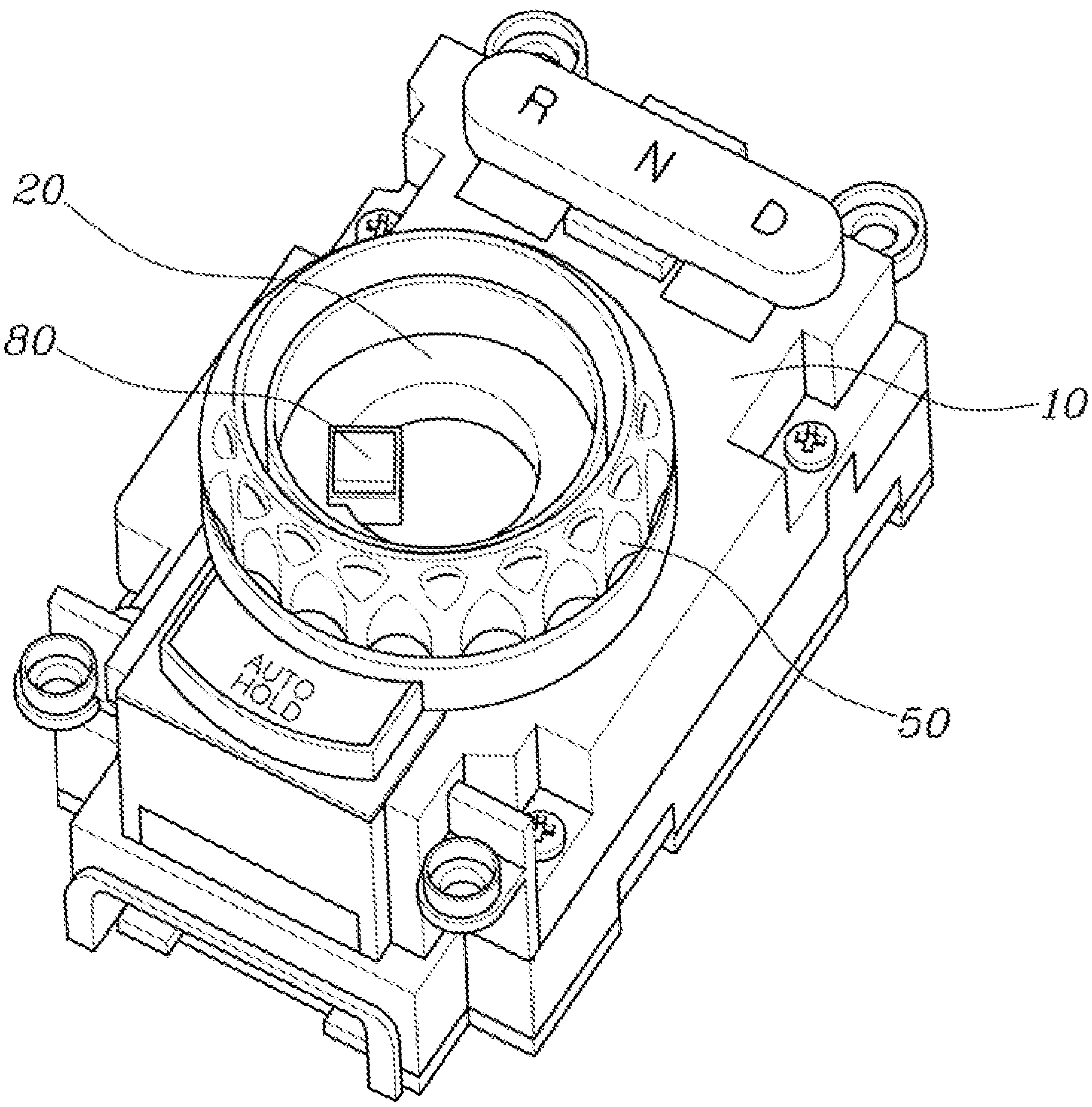


FIG. 3

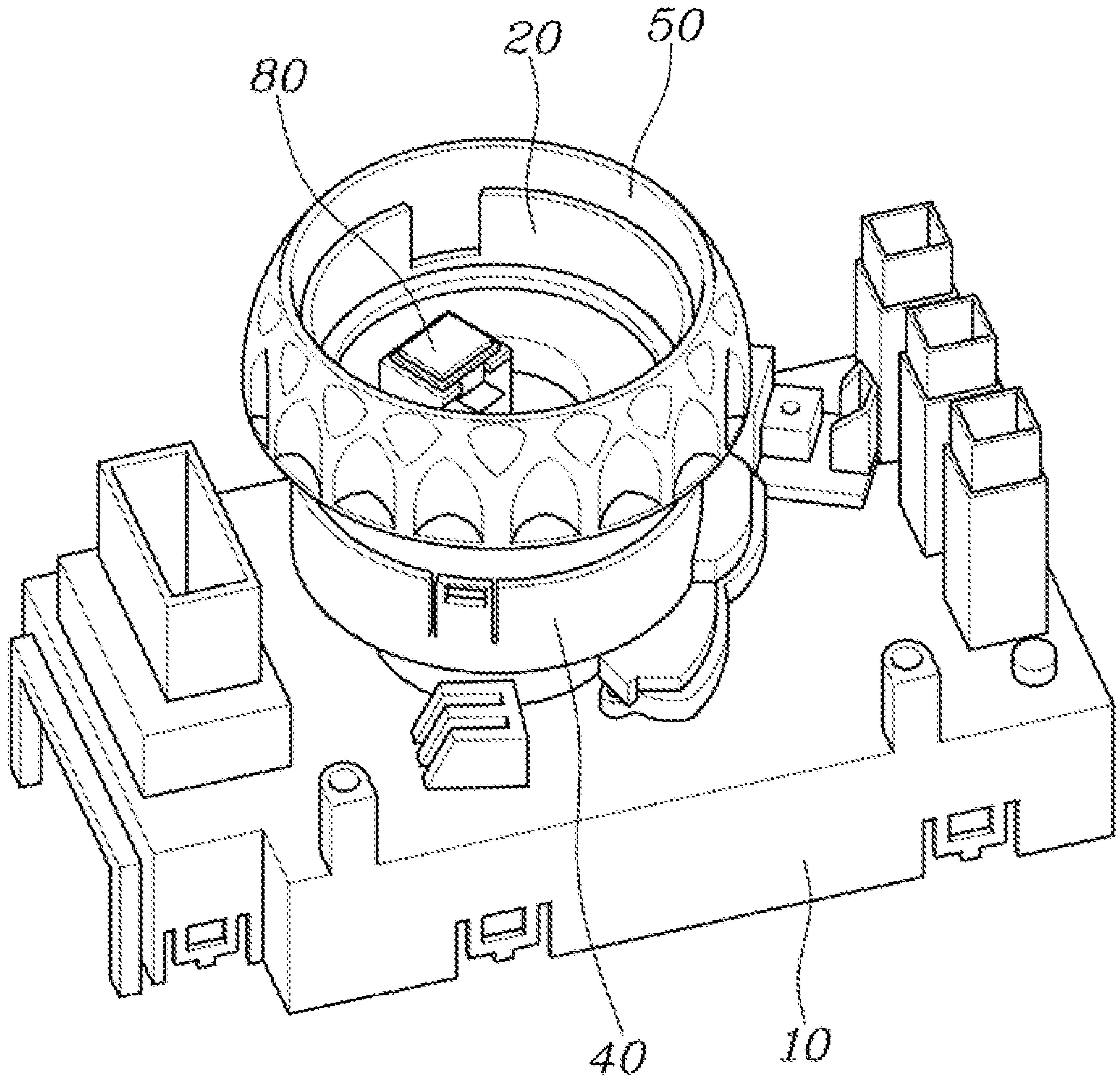


FIG. 4

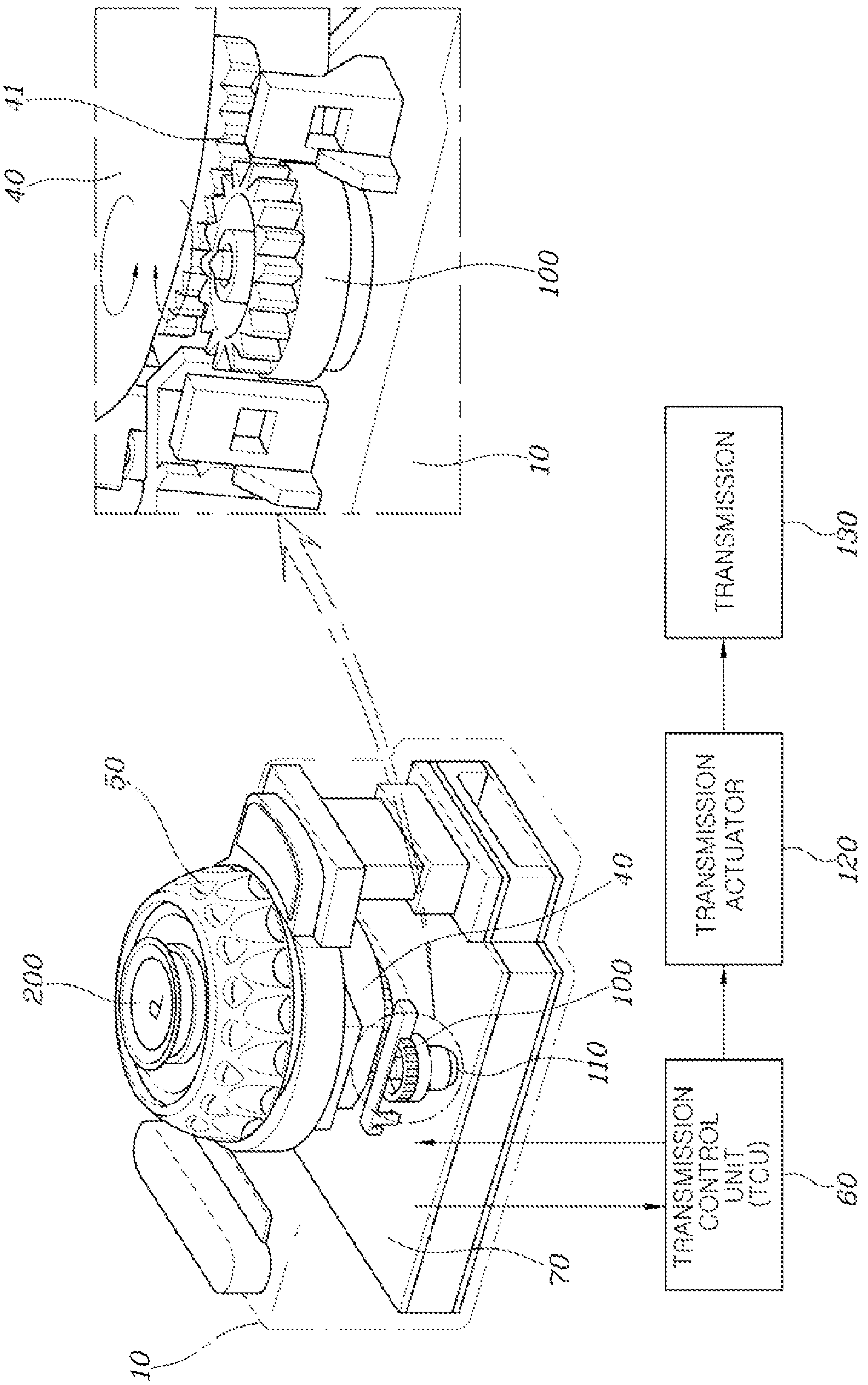

41
40
100
10
50
200
40
100
110
70
10
TRANSMISSION CONTROL UNIT (TCU)
60
TRANSMISSION ACTUATOR
120
TRANSMISSION
130

FIG. 5

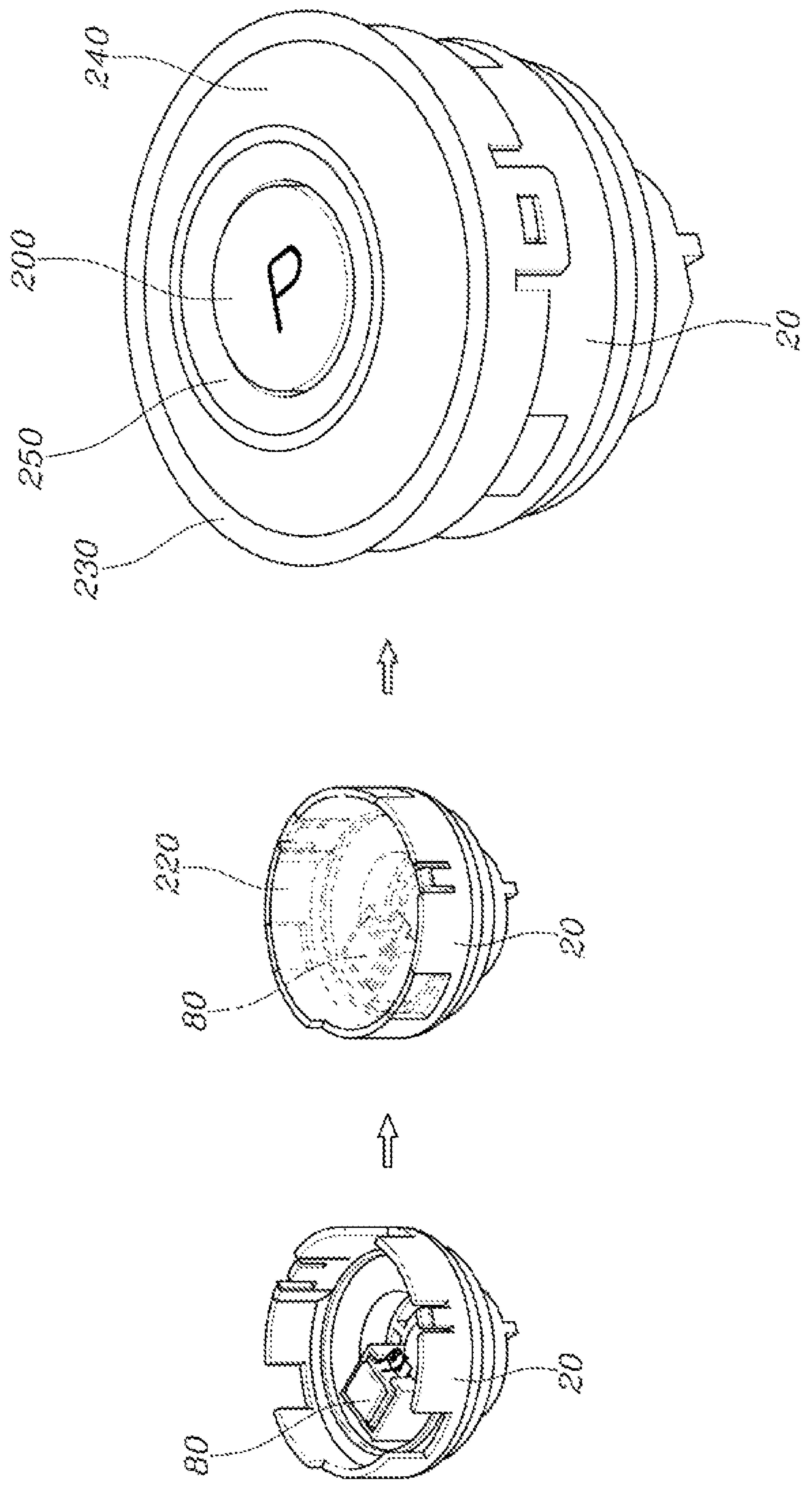


FIG. 6

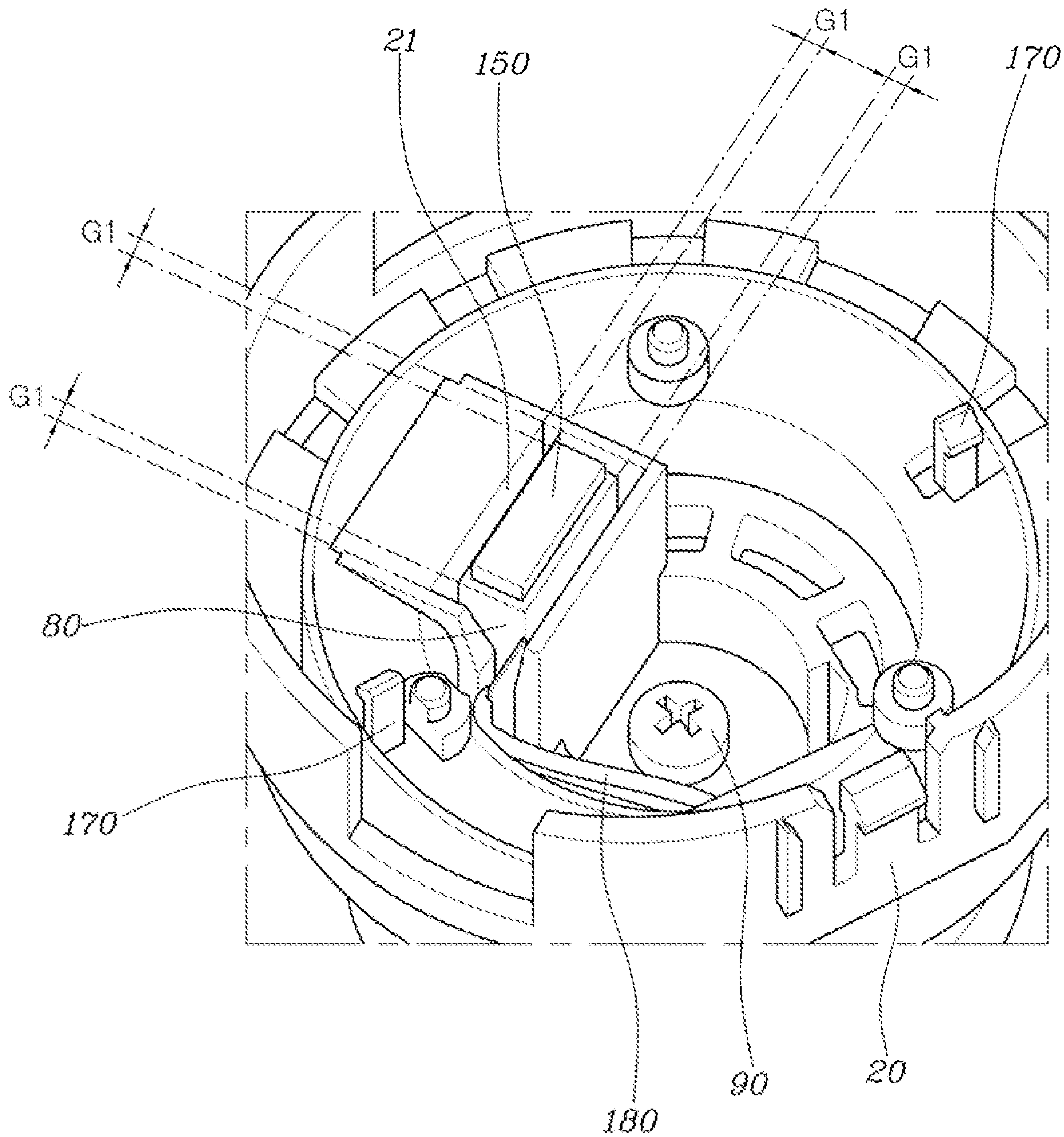


FIG. 7

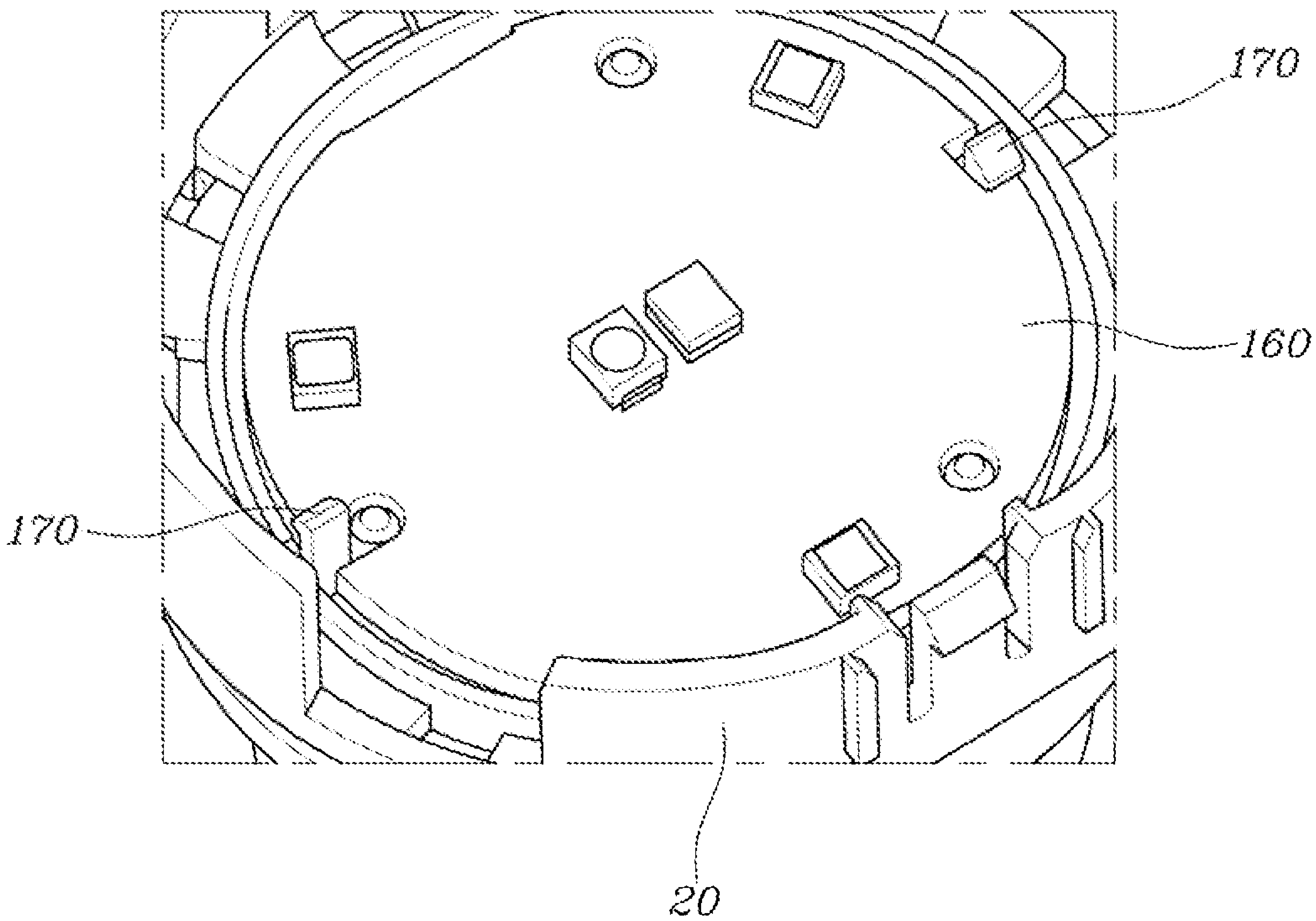


FIG. 8

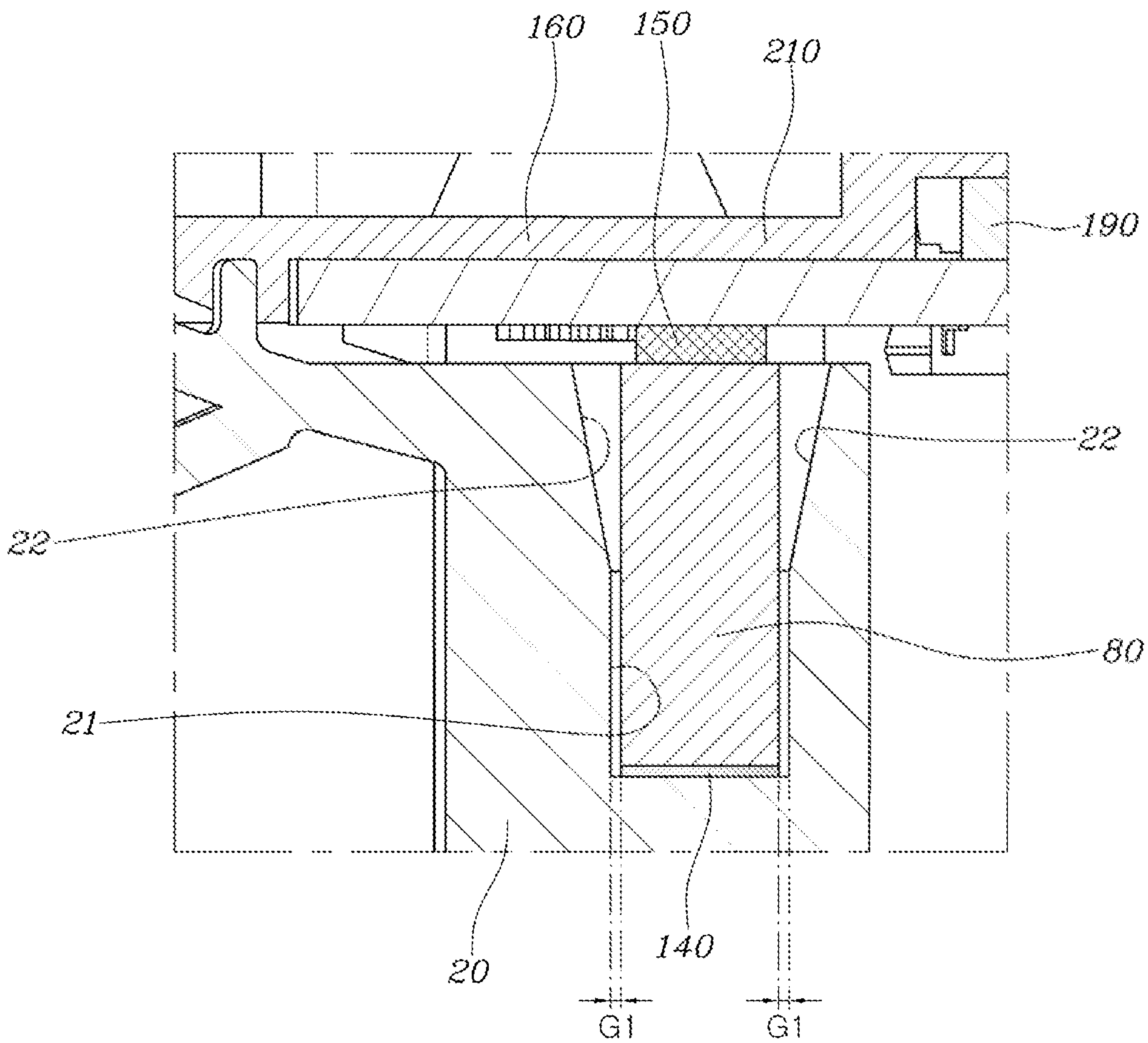
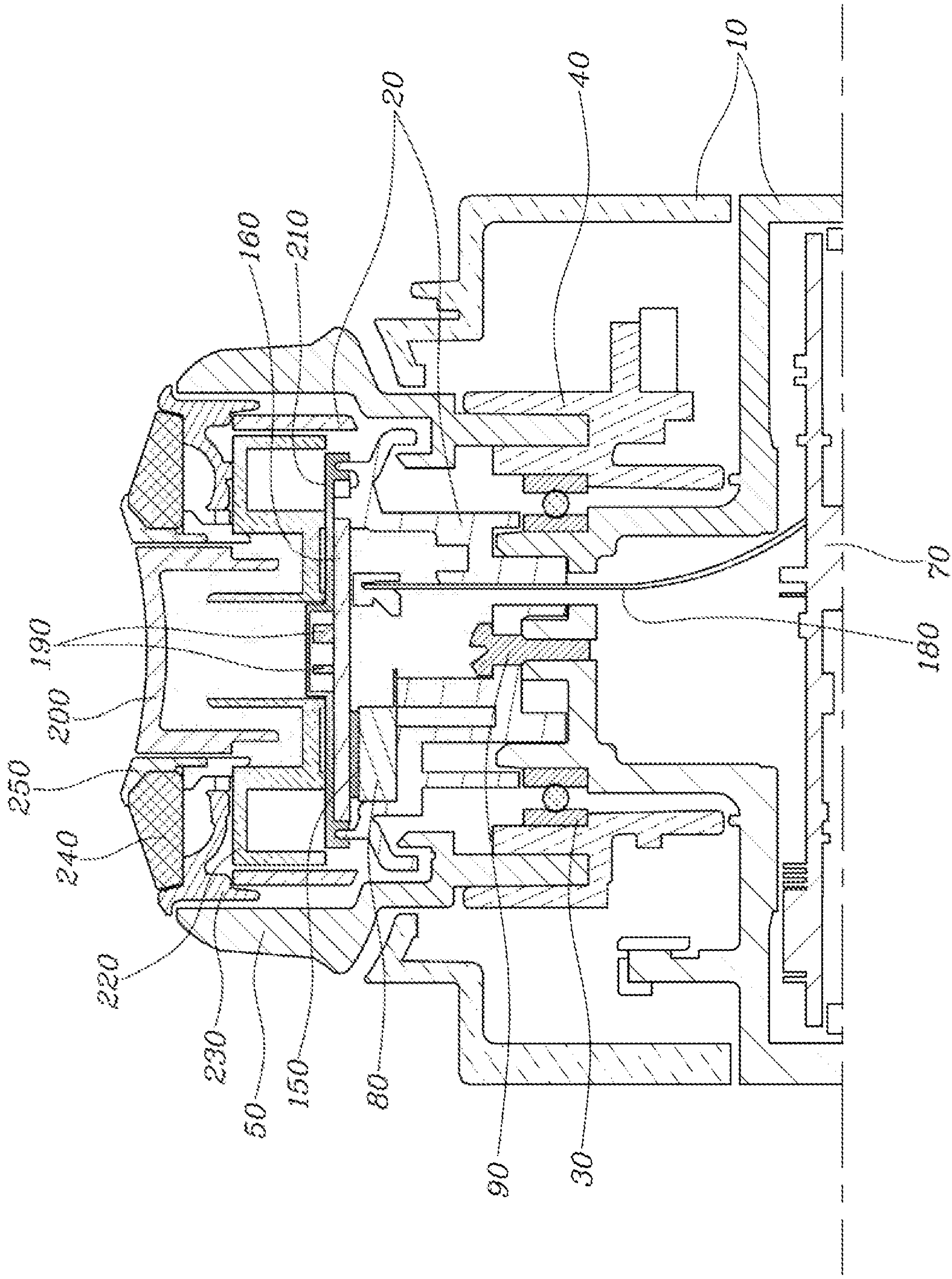


FIG. 9



ELECTRONIC SHIFT CONTROL APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

The present application is a continuation application of U.S. patent application Ser. No. 17/530,105, filed Nov. 18, 2021, which claims under 35 U.S.C. § 119(a) the benefit of Korean Patent Application No. 10-2021-0048915, filed Apr. 15, 2021, the entire contents of which are incorporated by reference herein.

BACKGROUND

(a) Technical Field

The present disclosure relates to an electronic shift control apparatus, more particularly, to the electronic shift control apparatus configured to prevent mis-operation by transmitting a haptic signal to a driver when the driver shifts into a specific shift range, which can minimize unnecessary transmission of vibration and noise from a haptic motor to other parts by applying an air gap around the haptic motor, and which can prevent damage to the haptic motor when the haptic motor is operated, using the air gap.

(b) Description of the Related Art

In general, in a vehicle equipped with an automatic transmission, gears of desired shift stages are automatically operated by controlling hydraulic pressure within a shift range set for the speed of the vehicle.

An automatic transmission generates gear ratios using a hydraulic circuit, a planetary gear set, and friction members to shift, and these components are controlled by a Transmission Control Unit (TCU).

A Shift-By-Wire (SBW) system, which is an electronic shift system for a vehicle, has no mechanical connection structure such as a cable between a transmission and a shift lever, unlike existing mechanical shift systems. In the SBW system, when a sensor value generated by operation of an electronic shift control apparatus (a shift lever or a shift button) is transmitted to the TCU, a solenoid or an electric motor is operated by an electronic signal from the TCU, and hydraulic pressure is selectively applied to the hydraulic circuit for each gear stage, thereby electronically controlling shifting.

Accordingly, an automatic transmission based on an SBW system has an advantage that shifting into a D (driving)-state, an R (rear)-stage, and an N-stage (Nd-stage or Nr-stage) is easily achieved by transmitting the intention to shift of a driver to a TCU using an electrical signal by simply operating an electronic shift control apparatus (a shift lever, button, or dial), and has another advantage that since the shift control apparatus can be formed in a small size, a wide area can be secured between the driver seat and the passenger seat.

As a method of shifting using an electronic shift system, in general, there is a lever type using a lever, a button type using a button, and a dial type using a dial.

The description provided above as a related art of the present disclosure is just for helping understanding the background of the present disclosure and should not be construed as being included in the related art known by those skilled in the art.

SUMMARY

The present disclosure relates to an electronic shift control apparatus having a shift dial that is operated by a driver to select an R-range, an N-range (Nd-range and Nr-range), and a D-range, and a P-range button that is operated to select a P (parking)-range, and an objective of the present disclosure is to provide an electronic shift control apparatus that can prevent mis-operation and improve safety by transmitting a haptic signal to a driver when the driver shifts into a specific shift range, particularly, that can minimize unnecessary transmission of vibration and noise from a haptic motor that generates a haptic signal to other parts by applying an air gap around the haptic motor, and that can prevent damage to the haptic motor when the haptic motor is operated, using the air gap.

In order to achieve the objectives of the present disclosure, an electronic shift control apparatus includes: a fixing bracket fixed to a main housing; a rotator installed to be rotatable with respect the main housing; a shift dial coupled to the rotator, the shift dial configured to rotate with the rotator by a driver so as to select any one of shift ranges of a vehicle when rotating; a main printed circuit board (PCB) fixed to the main housing and outputting a shift range signal selected by the shift dial to a transmission control unit (TCU); and a haptic motor fixed to the fixing bracket, the haptic motor being controlled to operate by the main PCB so as to generate a haptic signal when operating.

The shift range of the vehicle that is selected when the shift range is operated may be any one of an R-range, an N-range, or a D-range.

The electronic shift control apparatus may further include: a sensing gear rotatably coupled to the main housing and engaged with the rotator in an external gear type; and a magnet combined with the sensing gear, in which the PCB may output a shift range signal of any one of the R-range, the N-range, or the D-range based on a change of magnetic flux due to a position change of the magnet when the shift dial is rotated.

The haptic motor may be inserted and installed in an installation groove formed at the fixing bracket, a bottom of the haptic motor may be coupled to a bottom of the installation groove through an adhesive member, and front, rear, left, and right surfaces of the haptic motor may be spaced apart from the installation groove such that an air gap exists between the haptic motor and the installation groove.

The installation groove may be open upward, and a mouth of the installation groove may have an inclined surface such that a cross-sectional area thereof gradually increases upward.

The electronic shift control apparatus may further include a pad member coupled to a top of the haptic motor and absorbing vibration and noise that are generated when the haptic motor is operated.

The electronic shift control apparatus may further include a pad member coupled to the top and the bottom of the haptic motor and absorbing vibration and noise that are generated when the haptic motor is operated.

The electronic shift control apparatus may further include: a support PCB coupled to hook protrusions protruding upward further than the fixing bracket, fixing the position of the haptic motor in an up-down direction by pressing a top of the pad member, and connected to the main PCB through a wiring; and a P-range button disposed to be movable up and down at the center of the shift dial and configured to be pressed by a driver, in which the support PCB may generate and transmit a P-range signal to the main PCB when contact with the P-range button occurs.

Vibration and noise that are generated when the haptic motor is operated may be absorbed by the pad member and may not be transmitted to the support PCB.

The main PCB may operate the haptic motor only when a shift signal selected when the shift dial or the P-range button is operated and an actual shift signal of a transmission that is fed back through the TCU coincide with each other.

The haptic motor may be controlled to operate and generate a haptic signal by the main PCB when the shift dial is operated and the R-range is selected.

A haptic signal generated by the haptic motor may be transmitted to a driver's hand operating the shift dial through the main housing, the fixing bracket, the rotator, and the shift dial.

The haptic motor may be controlled to operate and generate a haptic signal by the main PCB when the P-range button is operated and a P-range is selected.

The electronic shift control apparatus may further include a dial guide, a dial bezel, a dial glass, and a dial liner that are combined to connect the fixing bracket and the P-range button to each other, in which a haptic signal generated by the haptic motor may be transmitted to a driver's hand operating the P-range button through the fixing bracket, the dial guide, the dial bezel, the dial glass, the dial liner, and the P-range button.

The haptic motor may be applied to other electronic shift control apparatuses of a lever type that enable shifting by operating a shift lever, a button type that enable shifting by operating a shift button, a column type in which a shift lever is disposed on a steering column, and a toggle type enabling shifting by operating a toggle switch.

The rotator may be rotated by a bearing disposed between the main housing and the rotator or between the fixing bracket and the rotator.

The electronic shift control apparatus according to the present disclosure includes the shift dial that is operated by a driver to select an R-range, an N-range (Nd-range and Nr-range), and a D-range, the P-range button that is operated to select a P-range, and the haptic motor that generates a haptic signal. Accordingly, when a driver shifts into a specific shift range (R-range or P-range) of a vehicle by operating the shift dial or the P-range button, the haptic motor is operated and a haptic signal (tactual signal) is configured to be transmitted to the driver, whereby it is possible to prevent mis-operation by the driver when shifting. Therefore, there is an effect that safety can be improved.

Further, since the air gap is formed around the haptic motor that generates a haptic signal in the present disclosure, unnecessary transmission of vibration and noise generated by the haptic motor to other parts can be minimized, whereby it is possible to improve durability of the parts.

Further, since the fixing bracket and the haptic motor can be spaced apart from each other by the air gap in the present disclosure, there is an effect that damage to the haptic motor due to the fixing bracket when the haptic motor is operated can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objectives, features and other advantages of the present disclosure will be more clearly understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a view of an electronic shift control apparatus according to the present disclosure;

FIG. **2** is a view showing the electronic shift control apparatus with a P-range button and a top of a shift dial removed;

FIG. **3** is a view illustrating the combination of a rotator and a bottom of the shift dial shown in FIG. **2**;

FIG. **4** is a view illustrating a sensing gear, a magnet, and a main PCB according to the present disclosure;

FIG. **5** is a view illustrating the configuration for connecting a fixing bracket and P-range button according the present disclosure;

FIG. **6** is a view illustrating the state in which a haptic motor is installed in an installation grove of the fixed bracket according to the present disclosure;

FIG. **7** is a view showing the state in which a support PCB is combined to cover the haptic motor in FIG. **6**;

FIG. **8** is a cross-sectional view of the portion where the haptic motor is installed in FIG. **7**; and

FIG. **9** is a cross-sectional view of the electronic shift control apparatus according to the present disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

It is understood that the term "vehicle" or "vehicular" or other similar term as used herein is inclusive of motor vehicles in general such as passenger automobiles including sports utility vehicles (SUV), buses, trucks, various commercial vehicles, watercraft including a variety of boats and ships, aircraft, and the like, and includes hybrid vehicles, electric vehicles, plug-in hybrid electric vehicles, hydrogen-powered vehicles and other alternative fuel vehicles (e.g. fuels derived from resources other than petroleum). As referred to herein, a hybrid vehicle is a vehicle that has two or more sources of power, for example both gasoline-powered and electric-powered vehicles.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. Throughout the specification, unless explicitly described to the contrary, the word "comprise" and variations such as "comprises" or "comprising" will be understood to imply the inclusion of stated elements but not the exclusion of any other elements. In addition, the terms "unit", "-er", "-or", and "module" described in the specification mean units for processing at least one function and operation, and can be implemented by hardware components or software components and combinations thereof.

Further, the control logic of the present disclosure may be embodied as non-transitory computer readable media on a computer readable medium containing executable program instructions executed by a processor, controller or the like. Examples of computer readable media include, but are not limited to, ROM, RAM, compact disc (CD)-ROMs, magnetic tapes, floppy disks, flash drives, smart cards and optical data storage devices. The computer readable medium can also be distributed in network coupled computer systems so that the computer readable media is stored and executed in a distributed fashion, e.g., by a telematics server or a Controller Area Network (CAN).

In the following description, the structural or functional description specified to exemplary embodiments according to the concept of the present disclosure is intended to describe the exemplary embodiments, so it should be understood that the present disclosure may be variously embodied, without being limited to the exemplary embodiments.

Embodiments described herein may be changed in various ways and various shapes, so specific embodiments are shown in the drawings and will be described in detail in this specification. However, it should be understood that the exemplary embodiments according to the concept of the present disclosure are not limited to the embodiments which will be described hereinbelow with reference to the accompanying drawings, but all modifications, equivalents, and substitutions are included in the scope and spirit of the present disclosure.

It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element, from another element. For instance, a first element discussed below could be termed a second element without departing from the right range of the present disclosure. Similarly, the second element could also be termed the first element.

It is to be understood that when one element is referred to as being "connected to" or "coupled to" another element, it may be connected directly to or coupled directly to another element or be connected to or coupled to another element, having the other element intervening therebetween. On the other hand, it should to be understood that when one element is referred to as being "connected directly to" or "coupled directly to" another element, it may be connected to or coupled to another element without the other element intervening therebetween. Further, the terms used herein to describe a relationship between elements, that is, "between", "directly between", "adjacent" or "directly adjacent" should be interpreted in the same manner as those described above.

Terms used in the present disclosure are used only in order to describe specific exemplary embodiments rather than limiting the present disclosure. Singular forms are intended to include plural forms unless the context clearly indicates otherwise.

Unless otherwise defined, all terms including technical and scientific terms used herein have the same meaning as commonly understood by those skilled in the art to which the present disclosure belongs. It must be understood that the terms defined by the dictionary are identical with the meanings within the context of the related art, and they should not be ideally or excessively formally defined unless the context clearly dictates otherwise.

A control unit (controller) according to exemplary embodiments of the present disclosure can be implemented through a nonvolatile memory (not shown) configured to store algorithms for controlling operation of various components of a vehicle or data about software commands for executing the algorithms, and a processor (not shown) configured to perform operation to be described below using the data stored in the memory. The memory and the processor may be individual chips. Alternatively, the memory and the processor may be integrated in a single chip. The processor may be implemented as one or more processors.

An electronic shift control apparatus according to exemplary embodiments of the present disclosure is described hereafter in detail with reference to the accompanying drawings.

An electronic shift control apparatus according to the present disclosure, as shown in FIGS. **1** to **9**, includes: a main housing fixed in the interior of a vehicle; a fixing bracket **20** fixed to the main housing **10**; a rotator **40** installed to be rotatable with respect the main housing **10**; a shift dial **50** coupled to the rotator **40**, the shift dial **50** configured to rotate with the rotator **40** by a driver so as to select any one of shift ranges of the vehicle when rotating; a main Printed Circuit Board (PBC) **70** fixed to the main housing **10** and outputting a shift range signal selected by the shift dial **50** to a Transmission Control Unit (TCU) **60**; and a haptic motor **80** fixed to the fixing bracket **20**, the haptic motor **80** controlled to operate by the main PCB **70** so as to generate a haptic signal when operating.

The main housing **10** may be fixed to a body of the vehicle such as a console, a center fascia, or the like close to a driver seat in the vehicle, but the installation position may be changed, if necessary.

The fixing bracket **20** may be fixed to the main housing **10** by a coupling member **90** such as a bolt or screw.

A bearing **30** is disposed between the main housing **10** and the rotator **40**, so the rotator **40** can be rotated with respect to the main housing **10** by the bearing **30**.

As another example, a bearing **30** is disposed between the rotator **40** and the fixing bracket **20** fixed to the main housing **10** through the coupling member **90**, so the rotator **40** can be rotated with respect to the main housing **10** and the fixing bracket **20** by the bearing **30**.

The bearing **30** includes an inner race, an outer race, and several balls disposed between the inner race and the outer race, the inner race is coupled to the main housing **10** or the fixing bracket **20**, and the outer race is coupled to the rotator **40**. Accordingly, the rotator **40** can be rotated clockwise or counterclockwise with respect to the main housing **10** and the fixing bracket **20** by the bearing **30**.

The rotator **40** is integrally coupled to a bottom of the shift dial **50** and extends downward from the shift dial **50**. When the shift dial **50** is operated by a driver, the shift dial **20** and the rotor **40** are rotated together clockwise or counterclockwise with respect to the main housing **10** and the fixing bracket **20**.

The main PCB **70** is disposed under the rotator **40**, is fixed to the main housing **10**, and is electrically connected to a power source (battery) of a vehicle to be able to be supplied with power.

The main PCB **70** has a function of outputting a shift range signal selected when the shift dial **50** is operated to the TCU **70** and a function of controlling the operation of a haptic motor **80**. The frequency, intensity, and number of times of vibration that is generated by the haptic motor **80** can be controlled to be changed by the main PCB **70**.

The shift range of a vehicle that is selected when the shift dial **50** is operated is one of an R-range, an N-range (Nd-range and Nr-range), or a D-range.

The rotator **40** has a groove protruding outward, the groove is in contact with a detent assembly having elasticity, and the detent assembly is fixed to the main housing **10**.

When the shift dial **50** is rotated, an operation feeling is generated by contact between the groove and the detent assembly. When a driver releases the rotated shift dial **50**, the rotated shift dial **50** is returned to the initial position by the elasticity of the detent assembly.

That is, the Nd-range is selected when the shift dial **50** is rotated one step clockwise from a Null-range and the D-range is selected when the shift dial **50** is further rotated one step clockwise from the Nd-range. Further, the Nr-range is selected when the shift dial **50** is rotated one step counterclockwise from the Null-range and the R-range is selected when the shift dial **50** is further rotated one step counterclockwise from the Nr-range. When the operation force is removed after the shift dial **50** is operated, the shift dial **50** is returned to the Null-range from the D-range or the R-range by the elasticity of the detent assembly being in contact with the groove.

The electronic shift control apparatus according to the present disclosure further includes a sensing gear **100** rotatably coupled to the main housing **10** and engaged with the rotator **40** in an external gear type, and a magnet **110** combined with the sensing gear **100**.

A gear part **41** having a predetermined length is circumferentially formed on the outer surface of the rotator **40**. The gear part **41** of the rotator **40** is engaged with the sensing gear **100** in an external gear type. The magnet **110** is fixed to the sensing gear **100** to face the main PCB **70**

When the shift dial **50** is rotated by a driver, the rotator **40** and the sensing gear **100** are rotated. As the sensing gear **100** is rotated, the main PCB **70** recognizes a shift range signal of any one of the R-range, the N-range (Nd-range and Nr-range), or the D-range based on a change of magnetic flux due to a position change of the magnet **110** and outputs the shift range signal to the TCU **60**.

A Shift-By-Wire (SBW) system that is an electronic shift system has no mechanical connection structure such as a cable between the shift dial **50** and the transmission of the vehicle. When the shift dial **50** is operated by a driver and any one shift range of the R-range, the N-range (Nd-range and Nr-range), and the D-range is selected, the main PCB **70** transmits the selected shift signal to the TCU **60**, a transmission actuator **120** is operated in response to a signal given from the TCU **60**, and hydraulic pressure is applied or cut to the hydraulic circuit of each of the shift ranges of a transmission **130** by operation of the transmission actuator **120**, whereby shifting is electronically performed by the transmission **130**.

An installation groove **21** having a predetermined size is formed at the fixing bracket **20** and the haptic motor **80** is inserted and installed in the installation groove **21** of the fixing bracket **20**.

An adhesive member **140** such as a double-sided tape is coupled to a bottom of the haptic motor **80** to fix the haptic motor **80**, so the haptic motor **80** is fixed to a bottom of the installation groove **21** by the adhesive member **140**.

When the haptic motor **80** is inserted and installed in the installation groove **21** of the fixing bracket **20**, the front, rear, left, and right surfaces of the haptic motor **80** is spaced apart from the installation grove **21** such that an air gap G**1** is formed between the haptic motor **80** and the installation groove **21**.

The air gap G**1**, which is a space existing between the haptic motor **80** and the installation groove **21**, blocks or minimize vibration and noise that is generated by the haptic motor **80** and unnecessarily transmitted to surrounding parts.

The installation groove **21** formed at the fixing bracket **20** is open upward and a mouth of the installation groove **21** (a section from a middle portion to a top in an up-down direction of the installation groove) is formed such that the cross-sectional area thereof gradually increases upward so that the haptic motor **80** can be easily inserted into the installation groove **21**. To this end, the mouth of the installation groove **21** may have an inclined surface **22**.

A pad member **150** made of rubber is fixed to a top of the haptic motor **80** inserted and installed in the installation groove **21**, and a support PCB **160** is fixed over the pad member **150**.

The pad member **150** is coupled to the top of the haptic motor **80** by an adhesive member, and when the haptic motor **80** is inserted and installed in the installation groove **21**, the upper portion of the pad member **150** is partially exposed out of the installation groove **21**.

Several hook protrusions **170** protruding upward further than the fixing bracket **20** are formed around the installation groove **21** and the support PCB **160** is held and fixed by the hook protrusions **170**. When the support PCB **160** is held and fixed by the hook protrusions **170**, a bottom of the support PCB **160** presses a top of the pad member **150**.

When the support PCB **160** is held and fixed by the hook protrusions **170**, rotation of the support PCB **160** is prevented by the hook protrusion **170**. Further, since the support PCB **160** presses the top of the pad member **150**, the position of the haptic motor **80** can be fixed in the up-down direction.

Vibration and noise generated when the haptic motor **80** is operated is mostly absorbed by the pad member **150**, so they are not or minimally transmitted to the support PCB **160**. Accordingly, damage to the support PCB **160** due to the vibration of the haptic motor **80** can be prevented.

The support PCB **160** is disposed over the main PCB **70**, and the main PCB **70** and the support PCB **160** are connected to each other through a wiring **180** to be supplied with power and to transmit/receive signals.

An LED **190** that takes charge of lighting is electrically connected to the support PCB **160**, so the LED is controlled to be turned on and off by the support PCB **160**.

As another example of the present disclosure, the pad member **150** may be coupled to both the top and the bottom of the haptic motor **80**, whereby it is possible to further improve the effect of reducing vibration and noise generated by the haptic motor **80**.

The electronic shift control apparatus according to the present disclosure further includes a P-range button **20** that is disposed to be movable up and down at the center of the shift dial **50** and is configured to be pressed by a driver. When contact with the P-range button **200** occurs, the support PCB **160** generates and transmits a P-range signal to the main PCB **70** through the wiring **180**.

When a driver presses the P-range button **200**, a switch rubber **210** disposed under the P-range button **200** is elastically compressed and comes in contact with the support PCB **160** and the support PCB **160** recognizes and transmits a P-range signal, which is generated when the P-range button **200** is operated, to the main PCB **70** through the wiring **180**. When the driver releases the P-range button **200**, the P-range button **200** moved downward is returned upward to the initial position by the restoring force of the switch rubber **210**.

The main PCB **70** operates the haptic motor **80** only when a shift signal selected when the shift dial **50** or the P-range button **200** is operated and the actual shift signal of the transmission **130** that is fed back through the TCU **60** coincide with each other.

That is, when a shift signal selected when the shift dial **50** or the P-range button **200** is operated is transmitted to the main PCB **70**, the main PCB **70** transmits the selected shift signal to the TCU **60**, the transmission actuator **110** is controlled to operate by the TCU **60** and actual shifting is performed in the transmission **130**, the actual shift signal of the transmission **130** is fed back to the main PCB **70** through the TCU **60**, and the main PCB **70** operates the haptic motor **80** only when the shift signal selected when the shift dial **50** or the P-range button **200** is operated and the actual shift signal of the transmission **130** that is fed back through the TCU **60** coincide with each other.

When the shift dial **50** is operated and the R-range is selected, the haptic motor **80** is controlled to operate and generate a haptic signal by the main PCB **70**. The haptic signal is transmitted to the shift dial **50** through the fixing bracket **20**, the bearing **30**, and the rotator **40** with a minimum loss, and is finally transmitted to the driver's hand operating the shift dial **50**. Accordingly, the driver receives a tactual signal due to vibration of the haptic motor **80**, whereby the degree of recognition of the driver operating the shift dial can be maximized.

Since the driver receives a haptic signal through the shift dial **50**, it is possible to prevent an accident due to wrong selection of the shift ranges, whereby it is possible to further improve safety when shifting.

When the P-range button **200** is operated and the P-range is selected, the haptic motor **80** may be controlled to operate and generate a haptic signal by the main PCB **70**. The haptic signal generated in this case is transmitted to the P-range button **200** through the fixing bracket **20**, a dial guide **220**, a dial bezel **230**, a dial glass **240**, and a dial liner **250**, and is finally transmitted to the driver's hand operating the P-range button **200**. Accordingly, the driver can receive a tactual signal due to vibration of the haptic motor **80**.

The support PCB **160** is coupled to the fixing bracket **20**, the dial guide **220** is coupled to the fixing bracket **20** to cover the support PCB **160**, the dial bezel **230**, the dial glass **240**, and the dial liner **250** are combined to cover the dial guide **220**, and the P-range button **200** is disposed at the center of the dial liner **250**.

Light generated by the LED **190** is exposed to the outside through the dial glass **240**, whereby it is possible to further esthetically improve the elegant image of the electronic shift control apparatus.

The configuration that the haptic motor **80** operates and generates a haptic signal when a driver operates the P-range button **200** is a selective matter, and the haptic motor **80** may not operate and may not generate a haptic signal when the P-range button **200** is operated.

The haptic motor **80** according to the present disclosure can be applied to and used for other shift control apparatuses of a lever type that enable shifting by operating a shift lever, a button type that enable shifting by operating a shift button, a column type in which a shift lever is disposed on a steering column, and a toggle type enabling shifting by operating a toggle switch.

As described above, the electronic shift control apparatus according to the present disclosure includes the shift dial **50** that is operated by a driver to select an R-range, an N-range (Nd-range and Nr-range), and a D-range, the P-range button **200** that is operated to select a P-range, and the haptic motor **80** that generates a haptic signal. Accordingly, when a driver shifts into a specific shift range (R-range or P-range) of a vehicle by operating the shift dial **50** or the P-range button, the haptic motor **80** is operated and a haptic signal (tactual signal) can be transmitted to the driver, whereby it is possible to prevent mis-operation by the driver when shifting. Therefore, there is an advantage that safety can be improved.

Further, since the air gap G**1** is formed around the haptic motor **80** that generates a haptic signal in the present disclosure, unnecessary transmission of vibration and noise generated by the haptic motor **80** to other parts can be minimized, whereby it is possible to improve durability of the parts.

Further, since the fixing bracket **20** and the haptic motor **80** can be spaced apart from each other by the air gap G**1** in the present disclosure, it is possible to prevent damage to the haptic motor **80** due to the fixing bracket **20** when the haptic motor **80** is operated.

If there is no air gap between the fixing bracket **20** and the haptic motor **80**, when the haptic motor **80** is operated, the fixing bracket **20** may be severely vibrated, and any vibration of the fixing bracket **20** is transmitted back to the haptic motor **80**, so the haptic motor **80** may be damaged. Therefore, according to the present disclosure, damage to the haptic motor **80** due to the fixing bracket **20** when the haptic motor **80** is operated can be prevented by the air gap G**1** between the fixing bracket **20** and the haptic motor **80**.

Although the present disclosure was described with reference to specific embodiments shown in the drawings, it is apparent to those skilled in the art that the present disclosure may be changed and modified in various ways without departing from the scope of the present disclosure which is described in the following claims.

What is claimed is:

1. An electronic shift control apparatus, comprising:
- a fixing bracket fixed to a main housing;
- a shift dial coupled to the main housing, the shift dial being configured to rotate with respect to the main housing by a driver so as to select any one of shift ranges of a vehicle when rotating;
- a first printed circuit board (PCB) fixed to the main housing and configured to output a shift range signal selected by the shift dial to a transmission control unit (TCU);
- a haptic motor fixed to the fixing bracket, the haptic motor being controlled to operate by the first PCB so as to generate a haptic signal when operating;
- a pad member coupled to a top of the haptic motor and absorbing vibration and noise that are generated when the haptic motor is operated; and
- a second PCB coupled to the fixing bracket, fixing the position of the haptic motor in an up-down direction by pressing a top of the pad member, and electrically connected to the first PCB.

2. The electronic shift control apparatus of claim **1**, wherein the shift range of the vehicle that is selected when the shift range is operated is any one of an R-range, an N-range, or a D-range.

3. The electronic shift control apparatus of claim **1**, further comprising:
- a sensing gear rotatably coupled to the main housing and rotated according to rotation of the shift dial; and
- a magnet combined with the sensing gear,
- wherein the first PCB outputs a shift range signal of any one of an R-range, an N-range, or a D-range based on a change of magnetic flux due to a position change of the magnet when the shift dial is rotated.

4. The electronic shift control apparatus of claim **1**, wherein the haptic motor is inserted and installed in an installation groove formed at the fixing bracket,
- a bottom of the haptic motor is coupled to a bottom of the installation groove through an adhesive member, and
- front, rear, left, and right surfaces of the haptic motor are spaced apart from the installation groove such that an air gap exists between the haptic motor and the installation groove.

5. The electronic shift control apparatus of claim **4**, wherein the installation groove is open upward, and
- a mouth of the installation groove has an inclined surface such that a cross-sectional area thereof gradually increases upward.

6. The electronic shift control apparatus of claim 1, wherein the pad member is coupled to a top and a bottom of the haptic motor and configured to absorb vibration and noise that are generated when the haptic motor is operated.

7. The electronic shift control apparatus of claim 1, further comprising:

a P-range button disposed to be movable up and down at a center of the shift dial and configured to be pressed by the driver,

wherein the second PCB generates and transmits a P-range signal to the first PCB when contact with the P-range button occurs,

wherein the second PCB coupled to hook protrusions protruding upward further than the fixing bracket.

8. The electronic shift control apparatus of claim 7, wherein vibration and noise that are generated when the haptic motor is operated are absorbed by the pad member and are not transmitted to the second PCB.

9. The electronic shift control apparatus of claim 7, wherein the first PCB operates the haptic motor only when a shift signal selected when the shift dial or the P-range button is operated and an actual shift signal of a transmission that is fed back through the TCU coincide with each other.

10. The electronic shift control apparatus of claim 7, wherein the haptic motor is controlled to operate and generate a haptic signal by the first PCB when the P-range button is operated and a P-range is selected.

11. The electronic shift control apparatus of claim 7, further comprising a dial guide, a dial bezel, a dial glass, and a dial liner that are combined to connect the fixing bracket and the P-range button to each other,

wherein a haptic signal generated by the haptic motor is transmitted to a driver's hand operating the P-range button through the fixing bracket, the dial guide, the dial bezel, the dial glass, the dial liner, and the P-range button.

12. The electronic shift control apparatus of claim 1, wherein the haptic motor is controlled to operate and generate the haptic signal by the first PCB when the shift dial is operated and an R-range is selected.

13. The electronic shift control apparatus of claim 1, wherein a haptic signal generated by the haptic motor is transmitted to a driver's hand operating the shift dial through the main housing, the fixing bracket, and the shift dial.

14. The electronic shift control apparatus of claim 1, further comprising a rotator configured to be rotated by a bearing disposed between the main housing and the rotator or between the fixing bracket and the rotator.

15. The electronic shift control apparatus of claim 1, wherein the second PCB is connected to the first PCB through a wiring to be supplied with power and to transmit and receive signals.

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